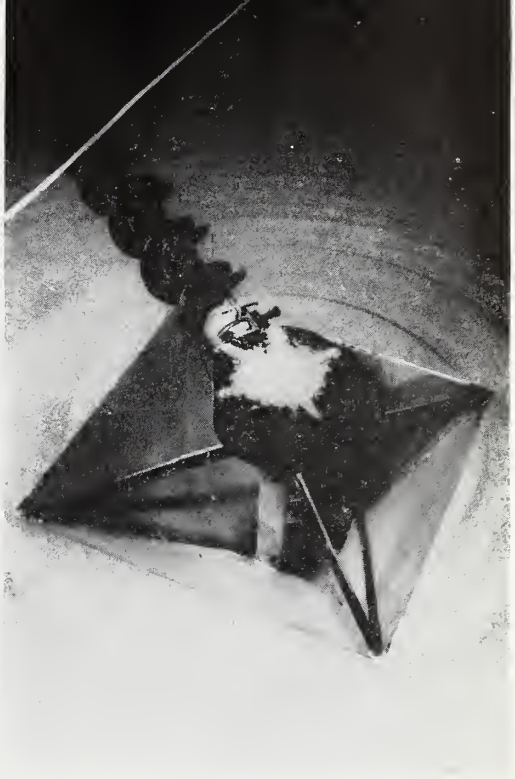
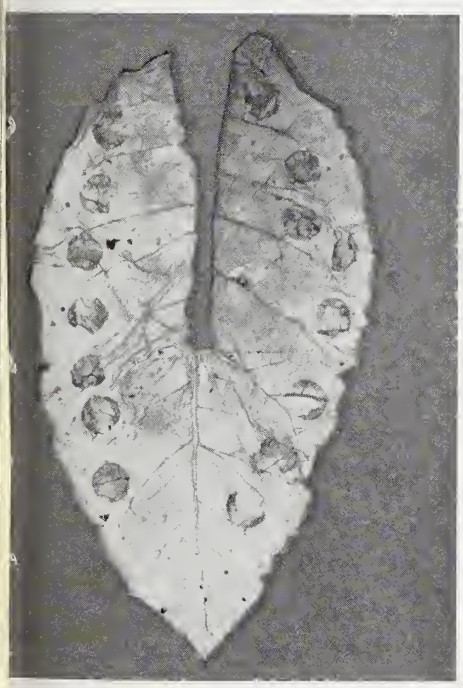
AGRICULTURAL Research

October 1958



AUTOMATIC UNLOADER

Page 8



TELLTALE ENZYME

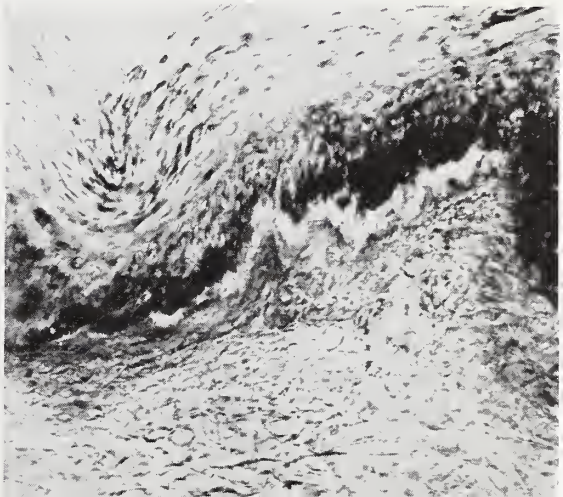
Page 5

TOBACCO BRUISES

Page 12

TAKING HAIR OFF HIDES

Page 3



U. S. DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 7—October 1958—No. 4

CONTENTS

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Team

In the early 1880's, the country's cattlemen were hard hit b a contagious cattle disease called pleuropneumonia.

Congress made history in 1884 by creating in USDA th Bureau of Animal Industry to deal with this disease. The Ac was significant because it not only authorized research but als gave the Bureau *regulatory powers* to bring the disease unde control. Within 5 years, the disease was wiped out.

This teaming of research and regulation set the pattern fo USDA's future development. The Department, in cooperatio with various States, is currently pushing eradication campaign against about a dozen new and old agricultural pests and di eases. These campaigns, combined with control efforts again another 13 pests, and with plant and animal quarantines, a administered as part of the Agricultural Research Service.

This has proved a sensible arrangement because research an regulation are an ideal team. Each serves the other.

It's much like industry's research and development organ zations. ARS research is often directed toward specific pes control problems. And pest-control field operations provid practical tests for research as well as directions for new wor

Take the Medfly outbreak in Florida in 1956. New tec niques and new scientific knowledge—including developme of an attractant just before the fly was discovered in this cou try—made possible the rapid approach to Medfly eradicatio

A campaign is underway to rid the Southeast of screwworm You have no doubt heard of the imaginative research job th found the way to eliminate screwworms from an area throug repeated releases of irradiation-sterilized flies.

Animal-disease research such as that at Plum Island is pro ising to broaden eradication and control efforts. Real improv ments will come with major research breakthroughs that gi us greater understanding of the diseases themselves.

The close working relationships between research and reg latory workers, between State and Federal agencies, and b tween government and industry put us in better shape than ev before to fight agricultural pests and diseases.

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EPIDERMAL layer (enlarged view), emoved from frozen ide, shows attached hair and glands. le had been soaked 5 days in 5-percent salt solution before being sectioned.

TAKING HAIR OFF HIDES

Salt-curing fresh hides, then treating with enzyme speeds hair removal, may improve quality

■ SALT HAS TRADITIONALLY BEEN USED to *preserve* hides. But more recent findings indicate it can be used to help speed up the *unhairing* of fresh hides as well.

Packers normally cure hides in salt for a month, then ship them to the tannery. There, another long treatment, in lime, loosens the hair so it can be efficiently removed prior to tanning. USDA researchers at the Eastern utilization division, Philadelphia, are working on a new enzyme treatment that will be more efficient than liming in loosening hair. This treatment may make it possible for packers themselves to remove the hair, thus saving shipping costs and permitting more accurate grading of hides when sold.

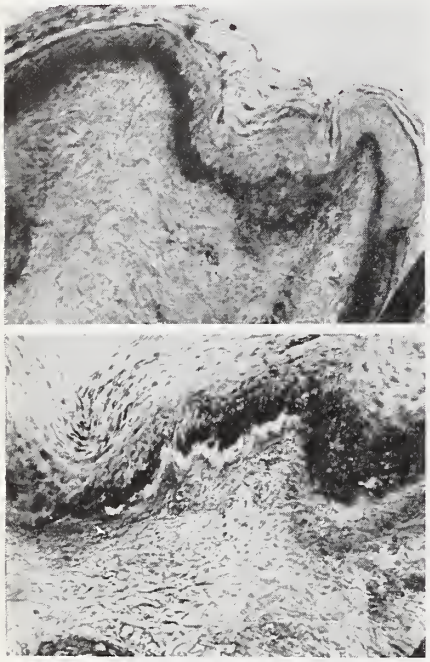
Could the hides be unhaired with enzymes immediately after they are removed from the animal without prior salt curing? To find out, ARS chemists A. L. Everett and T. C. Cordon enzyme-treated samples of fresh hides and hides cured in salt solutions of various concentrations. The hides were tested for hair looseness at intervals by means of a specially designed scraping device. They were also sectioned and stained by various methods for microscopic examination to detect any change in the tissues due to treatment.

The salt pretreatment contributed significantly to the unhairing action of the enzyme. Best results were obtained at a salt concentration of about 26 percent. Soaking the hides for 2 to 3 days caused faster unhairing than soaking for 1 day. But there was no apparent advantage in adding salt to the enzyme solution to replace preliminary soaking in salt. Nor was there any real difference whether the enzyme was at 40° or 45° C.

TURN PAGE

TAKING HAIR OFF HIDES

(Continued)



CROSS SECTIONS of fresh hides show the effect of salt treatment on the basement membrane, the tissue that largely controls hair retention. Upper hide had not been treated. Lower hide had been soaked in 9.1-percent salt solution and the basement membrane (dark curving horizontal line) altered. Black lines in lower right corners are hairs.

Microscopic examination of the stained sections showed several possible effects of salt pretreatment. One of the stains used, which is broadly specific for polysaccharides, deeply colored the basement membrane, lying between the dermis and epidermis. Salt treatments changed the appearance of this layer of the hide, and enzyme action removed it almost entirely. These findings indicate that the basement membrane is the principal site in unhairing action.

Some of the hides used in these experiments had been kept frozen. Tests on these uncovered a useful—but unlooked for—fact. Frozen hides always unhair faster than those that aren't frozen, regardless of salt concentrations. And the longer the hides are frozen, the faster the unhairing. The freezing was found to accelerate the response of hides to enzymes, and even to produce appreciable hair loosening after a 2-day to 3-day soaking in weak salt solutions. This salt treatment had no such effect on hides that had not been frozen.

Studies elsewhere provide a clue to this unusual behavior of frozen hides. There is a gradual increase in formation of ice crystals in intercellular spaces during slow tissue freezing. And this removal of water results in a corresponding increase in the concentration of electrolytes dissolved in tissue fluids. This build up of electrolytes accentuates the effect of the salt on the frozen hides. ☆

New Livestock Genetics Laboratory

■ A PIONEERING RESEARCH LABORATORY in Basic Animal Genetics has been set up in USDA. This newest of 12 laboratories set us by ARS for creative studies will be located in the Animal Husbandry Research Division.

Basic objectives will be to arrive at a clearer understanding of concepts of inheritance, gene behavior, and why and how mutations occur. There will be studies on effects of mating systems, selection for mating, and environmental factors on traits of animal offspring.

Quantitative studies will be conducted at the Population Genetic Research Institute at Purdue University, Lafayette, Ind. Chemical studies will be carried out at the Agricultural Research Center, Beltsville, Md.

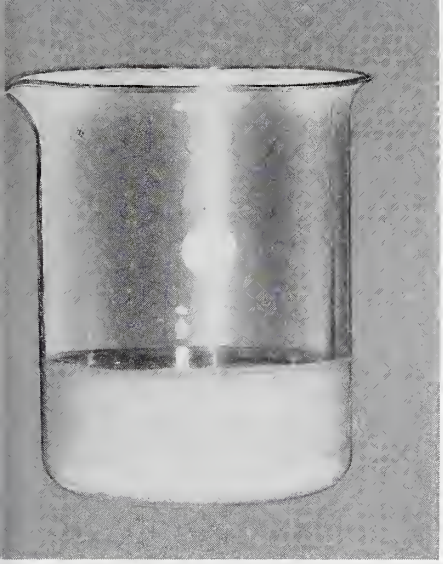
Researchers working at Purdue will use laboratory animals and insects (mice, fruit flies, flour beetles, and others) to work out experimental methods that can be applied in studying livestock genetics. The aim is to learn how a gene acts morphologically and physiologically in producing a character. It would expedite our research tremendously to know which livestock-breeding systems are most likely to bring about improvements when any one type of gene behavior determines the variations that will be transmitted for a given character.

The group at Purdue under Wendell H. Kyle will also evaluate new selection methods and breeding systems. New mutations that may be produced will be investigated thoroughly and described by the research team.

Beltsville researchers will study chemical composition of genes and the chemical reactions involved in gene effects, hereditary transmissions, and related phenomena. A leader for this work hasn't been selected.

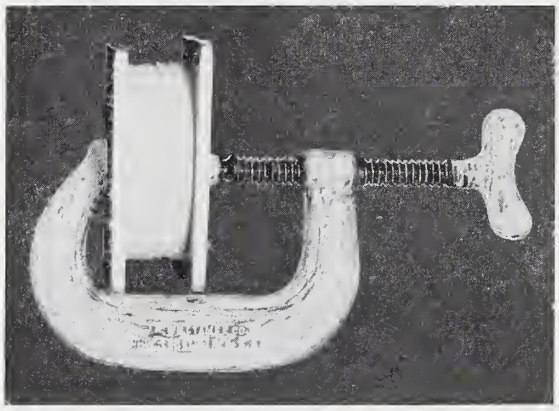
ARS is setting up pioneering research groups to explore uncharted scientific horizons in search of new scientific facts and principles. Plans for creation of the laboratories began to shape up as far back as February 1957. The first charter was issued in August of that year for basic studies of mineral nutrition of plants.

These Pioneering Research Laboratories have also been chartered: Blood Antigen, Plant Physiology, Microbiological Chemistry, Seed Protein, Plant Fibers, Allergens in Agricultural Products, Cellular Metabolism, Insect Pathology, Insect Physiology, and Plant Enzymes.☆



Filter-paper disks are soaked 30 to 60 onds in an alcohol solution containing 2 igents—ortho-tolidine and urea peroxide— nmonly used in testing of foods.

2. Saturated test papers are removed from chemical bath and pressed in a clamp to remove surplus liquid.



3. Moist papers are hung on line for 30 minutes to dry. Then they are stored at low temperature until needed for tests.

4. Freshly-cut blanched vegetable (just below) is pressed against test paper and timed until blue color appears. Quick coloring means inadequate blanching. Vegetable extract applied by pipette (bottom) shows average enzyme activity.

Here's a Quick Test for a . . .

TELLTALE ENZYME

■ An accurate, new time-saving device that tests for enzyme activity after blanching will help in maintaining quality control in vegetable freezing plants.

Developed by USDA scientists, the device is a filter paper that has been treated with the chemicals ortho-tolidine and urea peroxide. The blanched pea, corn kernel, or any other vegetable is pressed against the treated paper. The time it takes (within very narrow limits) for the paper to change color is a clue to the efficiency of the blanching process. If the color does not change within

TURN PAGE

TELLTALE ENZYME

(Continued)

a minute or a little longer, that indicates the right amount of blanching. With a little experience, quality-control men can effectively use the test with various products under various conditions.

The paper shows the activity of the enzyme peroxidase, found in all frozen vegetables. There are many enzymes in vegetables but peroxidase is the easiest to detect and measure. In addition, it is present in nearly all plant material, making it convenient to use in evaluating the extent of blanching in many products.

Vegetables to be frozen need careful blanching

Changes, presumably enzymatic, in freezing processing can cause loss of desirable substances such as vitamins and formation of undesirable substances that cause objectionable color and flavor. These changes are prevented or reduced by blanching with steam or hot water. But too much blanching isn't good, either. Best quality requires blanching just enough to inactivate enzymes.

The test for peroxidase activity can be run two ways, depending on the information desired. If the quality-control man wants the average peroxidase activity of a sample, he makes an extract of the food, places a drop or two on the paper, and waits for the color change.

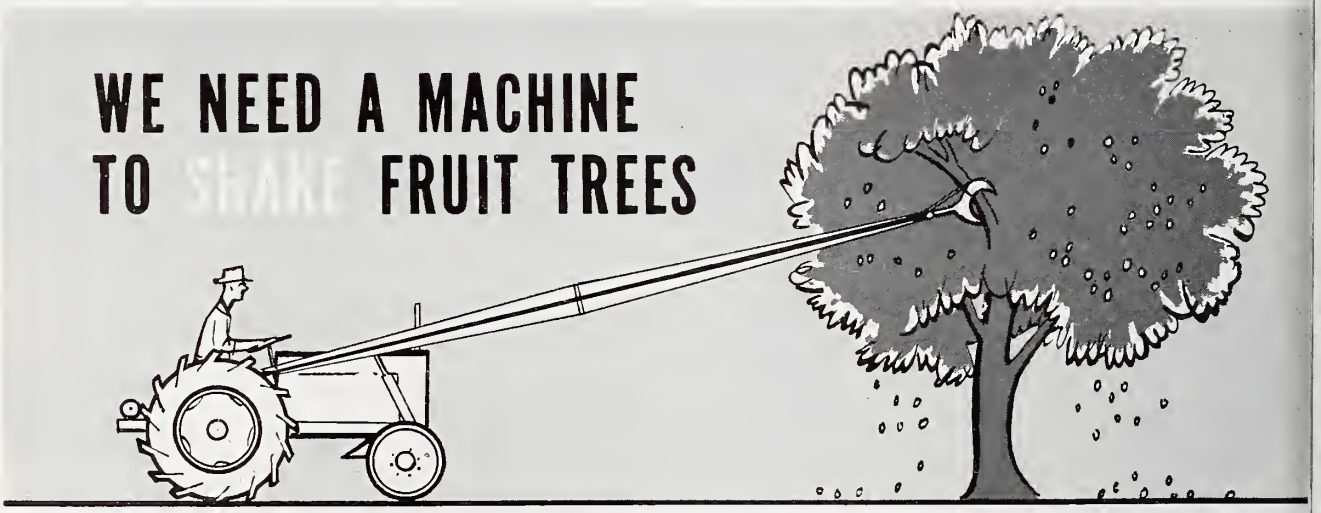
Method works for food piece as well as extract

If he wants to know the variations in the peroxidase activity of different areas of the vegetable, he can press the cut piece against the paper. This will show the portions where peroxidase has been inactivated.

The latter use is especially unique in measuring enzyme activity without destroying the sample, and may prove to be unusually valuable to food processors.

ARS chemist H. J. Morris of the Western utilization division, Albany, Calif., developed the new test paper. It can be easily prepared in any laboratory and safely stored at low temperatures. Use of the paper eliminates the need for test tubes, pipettes, and burettes.☆

WE NEED A MACHINE TO SHAKE FRUIT TREES



■ Mechanical shaking of trees for fruit removal is under study by USDA and State researchers. The aim is to remove a maximum of good fruit with minimum power and tree damage.

ARS agricultural engineer P. A. Adrian, in cooperation with R. B. Fridley at California Agricultural Experiment Station, Davis, gives three variables affecting fruit removal:

1. Frequency of shake (that is, the number of cycles per minute).

2. Stroke (the distance the piston plunges in either direction).

3. Force needed to remove fruit divided by weight of the fruit (F/W).

4. Number of limber fruit-bearing branches in any given tree.

A 20-foot mounted boom shaker was tested at frequencies ranging from 400 to 1,000 cycles per minute and at strokes of ½, 1, and 1½ inches.

Minimum tree damage occurred at 700 to 900 c. p. m. Limb breakage generally increased with an increase in stroke length; the 1½ inch stroke used with a low frequency caused the most limb breakage. The higher the frequency, the smaller were the differences in the percent of fruit removed by the three strokes.

Tests showed that the most fruit is removed from the most rigid trees—that is, trees with the fewest limber fruit-bearing branches.

Observations of fruit-tree shaking by machine are in their initial stages. Factors yet to be evaluated include power requirement, position of shaker clamp on limb, and F/W (force required to remove the fruit divided by weight of fruit). ☆

FOREST FIRE PRINCIPLES WILL BE STUDIED

■ How do forest fires burn and how can they be controlled? The Forest Service is seeking answers to these basic questions through research in two new fire-research laboratories.

The information being sought will guide the Service and other fire protection agencies in developing new and more efficient ways to protect valuable woodlands and cut down millions of dollars in losses which forests suffer yearly from wild fire.

One laboratory is already under construction at Macon, Ga., and the second at Missoula, Mont., will be started soon. These laboratories will have wind tunnels, controlled temperature and humidity rooms, electric ovens, and other facilities for physical and chemical research.

The characteristics of green and dead forest vegetation that makes up fuel for forest fires and the flammability of different types of vegetation under various atmospheric conditions will receive considerable attention in the new laboratories.

The researchers hope to identify distinctive and recognizable fuel types in which fires perform in characteristic ways. They'll try to learn what natural laws affect fire in the woods and why fire responds in certain ways to weather. With this information new suppression principles and methods will be developed and tried out under varying conditions.

The Macon laboratory is a joint undertaking of the Forest Service and the State of Georgia. State funds were used for construction of the building and Federal funds will equip and staff the laboratory. K. W. McNasser, chief of fire research at the Southeastern Forest Experiment Station, will supervise the research.

As one of its major projects, this laboratory will direct its research on flammability of vegetation to local conditions to find out why some fires blow up without warning and become wholly unmanageable. When the conditions that indicate a blowup are known, foresters will be able to predict fire behavior and plan their control strategy accordingly.

Northern Forest Fire Laboratory, under supervision of J. S. Barrows of the Intermountain Forest and Range Experiment Station, will work closely with Montana State University and other western schools and private, State, and Federal forest-protection agencies. Located at the aerial fire depot at the Missoula airport, the laboratory will have the use of aircraft and smokejumper facilities.

The laboratory will facilitate present Skyfire research (Agr. Res. June 1957, p. 8) and, in addition, study surface weather characteristics that are associated with thunderstorms and govern behavior of lightning fire. ☆

RAINMAKER—Research Expediter

■ An experimental rainfall simulator reduces time and cost of measuring water runoff and soil erosion.

The apparatus, devised by USDA engineers and soil scientists in cooperation with Purdue University, enables scientists to predict with greater accuracy the infiltration rates and erosion of soils being cropped. Many studies that depend on a wide range of rainfall conditions formerly took 10 to 25 years but can now be done with the new equipment in just as many months.

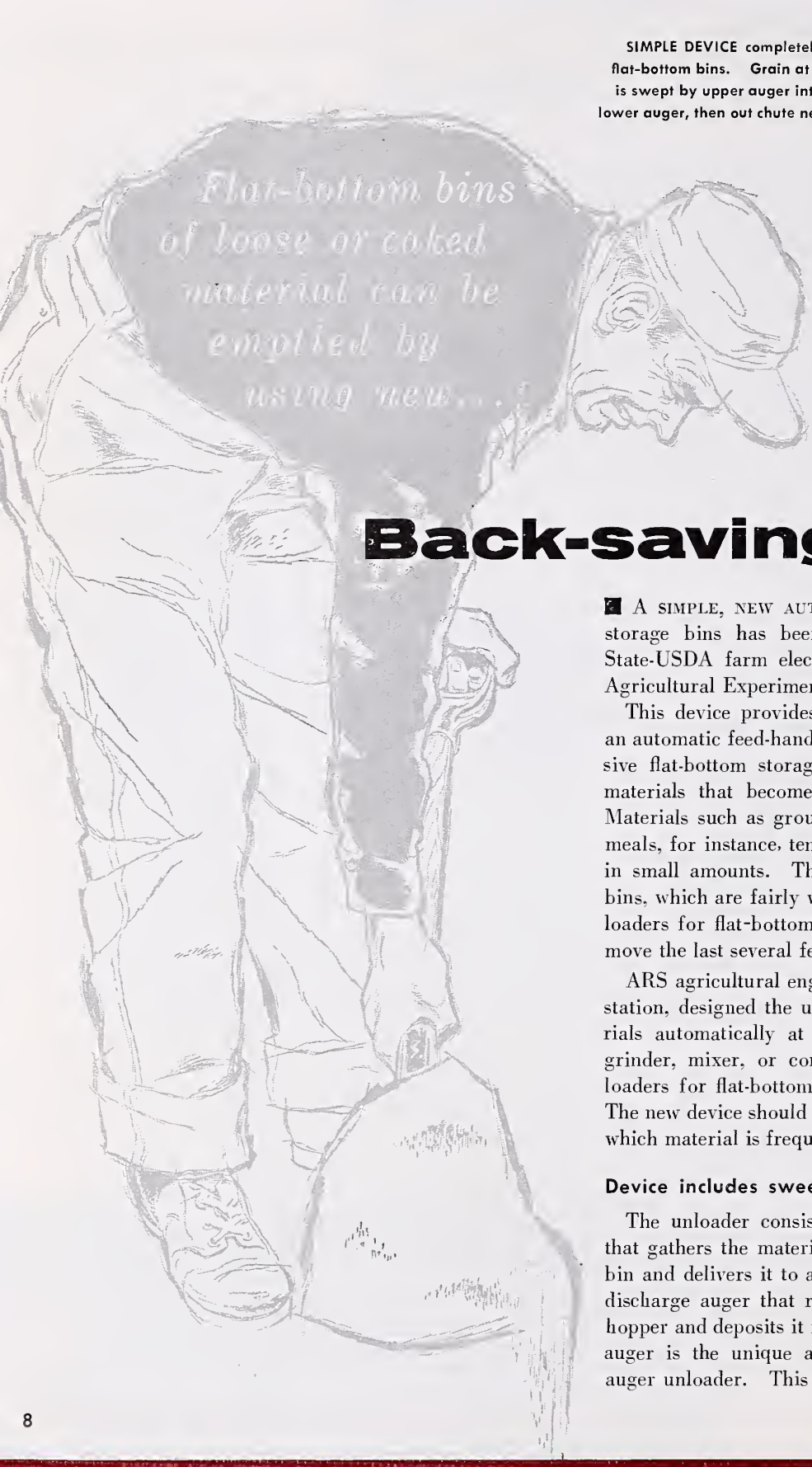
Designed for field-scale use, the device facilitates the comparison of subsoiling, vertical mulching, and conventional tillage on corn, pasture, and permanent sod.

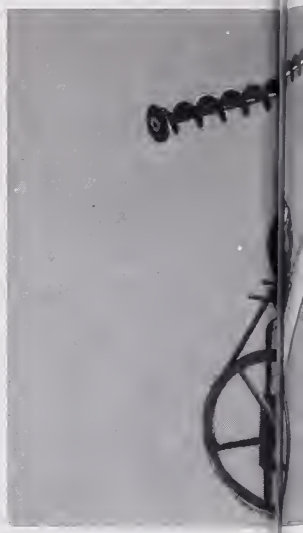
Large, flat spray nozzles are directed downward from 8-foot frames. Nozzles move back and forth across the plot, spraying in one direction only. Impact, number, and size of drops approach those of natural raindrops.

A few heavy rain storms cause most natural annual soil loss. So the simulated storms range from 2½ to 5 inches of rain per hour and usually last for about 1 hour.

Troughs placed diagonally across plots measure the amount of "rainfall" that has been produced. The water is channeled through a flume to measure the amount and rate of runoff. To determine soil loss, 1 percent of the runoff is collected and measured for soil content. ☆

RAIN SIMULATOR is built in sections that can be grouped in various ways to create type of precipitation that's to be studied. Set assembled here will produce a uniform storm on several experimental plots.





SIMPLE DEVICE completely empties flat-bottom bins. Grain at floor level is swept by upper auger into encased lower auger, then out chute near wheel.

Back-saving Autom

A SIMPLE, NEW AUTOMATIC UNLOADER for flat-botton storage bins has been developed through cooperativ State-USDA farm electrification research at the Illinoi Agricultural Experiment Station, Urbana.

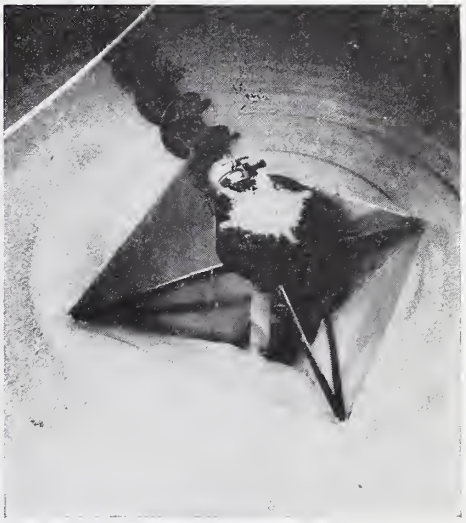
This device provides a dependable supply of feed fo an automatic feed-handling system, utilizes the less-expen sive flat-bottom storage bins, and effectively breaks u materials that become lumpy and compact in storage Materials such as ground ear corn, ground feed and o meals, for instance, tend to cake and are hard to remov in small amounts. This may be true of hopper-botto bins, which are fairly widely used. But even present u loaders for flat-bottom bins require manual labor to r move the last several feet of stored material.

ARS agricultural engineer H. B. Puckett, at the Illino station, designed the unloader primarily to handle mat rials automatically at a low rate to an automatic fee grinder, mixer, or conveyor. Such a low-capacity u loaders for flat-bottom bins require manual labor to r The new device should be used in an active bin—one fro which material is frequently withdrawn.

Device includes sweep and discharge augers

The unloader consists of two augers—a sweep aug that gathers the material from the floor and sides of t bin and delivers it to a small hopper in the center, and discharge auger that removes the material in the cent hopper and deposits it into another conveyor. The swe auger is the unique addition to an otherwise ordina auger unloader. This new auger is pivoted at the cent

CAKED FEED is broken up here as sweep auger makes its way around the floor. Materials like ground ear corn, ground feed, oil meals, and fertilizers tend to cake and must be shoveled out of many other bins.



THOROUGH job done by machine is shown by the thinness of feed layer left. Feed pattern shows circular gathering action of auger.

ıtic Unloader

of the hopper in the center of the bin and operates a fraction of an inch above the floor. Clearance varies depending on the evenness of the floor. And of course, the nearer the auger is to the floor without touching it, the cleaner the bin will be after unloading.

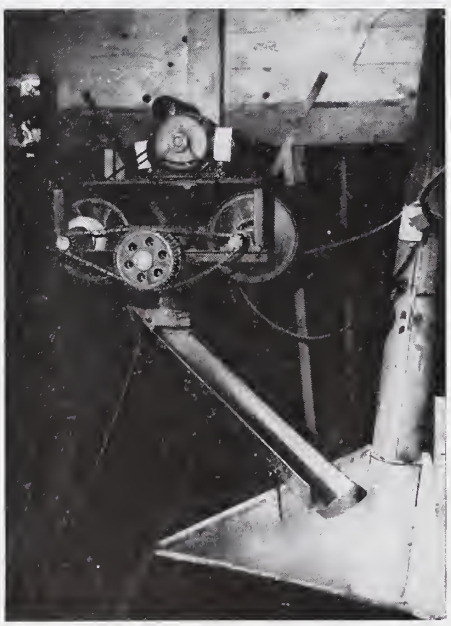
Another unique feature is that the torque (force tending to produce rotation) in the vertical drive shaft of the sweep auger propels this auger over the floor. A drag brake was added to the sweep auger to increase the torque in the vertical drive shaft. Regulation of this brake loads the auger properly to handle various materials, thus preventing overloading of the motor.

Size of auger, speed, power unit variable

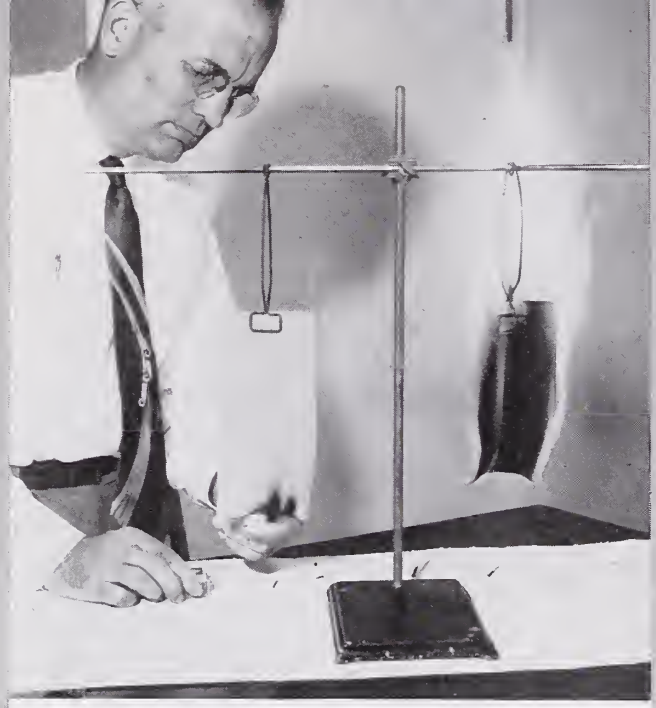
The rate of discharge is controlled by auger sizes, speeds at which they operate, and size of electric power unit used. The pilot model is designed around 6-inch augers. The sweep auger runs at 150 revolutions per minute and the discharge auger at 100 r. p. m. Each auger is driven separately by a ½-horsepower motor.

The unloader withdrew 22,000 pounds of shelled corn or 18,000 pounds of soybean oil meal per hour. The capacity could be increased easily by using larger motors and operating the augers at higher speed.

A larger test model was built for a 14-foot-diameter steel grain bin. A higher gear ratio provided sufficient torque in the vertical drive shaft to make the longer-sweep auger bite into the grain. A small wheel was placed on the end of the auger to relieve the bind. The sweep auger was driven at 180 r. p. m.☆



MATERIAL discharges through chute into a container. Or material can empty directly into an automatic feeder or go by conveyors to a grinder or mixer.



FLAME-RESISTANT FABRIC only chars, while untreated cloth flames freely. Such treatments are desirable for baby blankets, bedding, curtains, and other garments and linens.

Formula I

Borax	7 oz.
Boric acid	3 oz.
Hot water	2 qt.

Form a paste by dissolving the powdered boric acid in a little hot water. If stored, the solution becomes turbid and jelly-like, but it will clear as soon as it's warmed.

Formula II

Borax	6 oz.
Diammonium phosphate	6 oz.
Water	2 qt.

This formula is slightly less efficient flame retardant than Formula I, but has greater glow-retardant properties. Afterglow of treated fabrics is about 10 seconds.

Formula III

HOME · FOOD & HOME · FOOD & HO

Recipes for SAF

Four new ways to make fabrics resist flame can reduce a major risk of home damage and injury

DANGER OF FIRE damage and injury can be greatly reduced by using USDA's do-it-yourself formulas to make cotton and similar fabrics resistant to both flame and afterglow.

The procedure is simple. The chemicals are inexpensive and can be bought in almost any drugstore.

The process is no more complicated than the starching operation many housewives use. Consequently, its use is desirable, particularly on curtains and drapes, children's clothes, and flannel robes, gowns, and pajamas. The one shortcoming in all of the four formulas is that the flame retardant must be renewed in the fabric after each laundering.

The system, described by chemists at the ARS Southern utilization division at New Orleans, is the same with all four formulas. Clean, dry cotton, linen, or rayon (not acetate) items must be thoroughly wetted in enough solution to cover them, then dried. The fabric may be damp-dried in the family automatic washer, if you immediately rinse out the washer thoroughly. The items should then be dried on the clothes line, since difficult-to-remove chemical deposits might be left in an automatic dryer.

Detergent may help some fabrics

Some materials may be difficult to wet thoroughly because of their water repellency. Often new fabrics do not wet easily because they contain natural waxes, starch, or some other finishing agent. A teaspoonful of liquid detergent added to each gallon of flame-retardant solution will overcome this and not harm the fabric.

Fabrics treated with any of these formulas can be ironed with a moderately hot iron. If the fabric is too wet or the iron too hot, the flame retardant will stick and make ironing difficult. When this happens, wipe the iron with a clean wet cloth and you're back in business.

It would be a good idea when practical to test the procedure by treating scraps of the fabrics to be treated and

iammonium phosphate 12 oz.
Vater 2 qt.

This is a more effective ormula with the resin-treated otton and rayon fabrics classed s "crushproof" and "drip-dry." : will reduce strength of fabrics ightly over a long period of me.

mmonium sulfate 13 oz.
Vater 2 qt.

Add enough household ammonia to give a slight odor to the olution. If you use a fertilizer rade of ammonium sulfate train the solution through a loth to remove all of the undissolved particles.

ETY

bserving the flame and glow resistance after drying.

Cautious tests are advised

A word of caution is needed here. Do not hold the test scraps in your hand. The samples should be hung where there is no possibility of an accident and so they can be lit from the botttom. Properly treated, the fabrics will be flame resistant; that is, they will not support a flame after the match is removed. The scraps will also be glow resistant; the afterglow will die in a very short time.

Weathering and laundering destroy effectiveness of these flame retardants, but that's a small consideration compared with the protective value and simplicity of the treatments. ☆

How we got A NEW CRIMSON CLOVER

CHIEF COMMON

THE SOUTHEAST WILL BE ABLE TO BUY the new hard-seeded, volunteering Chief crimson clover next year, thanks to a patient method of selection that isolated these superior offspring from common stock seed.

Commercial distribution will wind up 20 years of cooperative effort by USDA and the Mississippi Agricultural Experiment Station. They sought a hard-seeded, late-maturing clover that would maintain good stands through the fall and come back strongly for several years without seeding. The resulting Chief, another forage for the Southeast's fast-growing cattle industry, will also find use in soil conservation.

The selection method worked out by ARS and Mississippi agronomist H. W. Bennett, utilized a weakness and a strength in parental stock.

The parent's weakness is a permeable seed coat that allows water to be absorbed rapidly. This may cause germination soon after the seed is ripe—during midsummer when dry spells are common. Such seedlings do not survive, or are too poorly established to produce through fall.

But nearly all common crimson clover has a small but varying percentage of hard-seed offspring. It was this superior trait that Bennett successfully exploited. By rigorously selecting hard seeds from large amounts of common seeds—using a water-soak method—he screened and isolated progeny lines with increasing percentages of hard seed.

In 1939 a composite lot of seed was soaked in water for 3 days, then rubbed between the hands, and the broken and swollen seeds were floated off. The remaining small percentage of hard seed was planted. Seed from these plants was hand-threshed, consolidated, and water-soaked for 3 days. Hard seed recovered from this lot was planted in 1940. The plot was rolled in the spring of 1941 and left to volunteer seed.

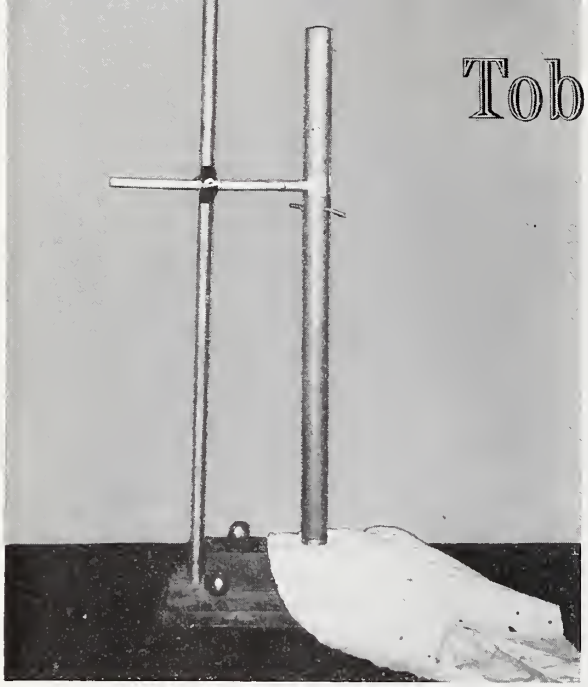
Seeds from 300 of the volunteer crimson clover plants that survived in best condition into 1942 were harvested. Their seeds—largely hard—were bagged separately. Samples of seed from each plant were rigorously subjected to the soak-and-discard procedure. Only progeny lines that included more than 20 percent hard seed were retained and grown. In succeeding years, progressively higher levels of hard-seededness were required for retention. And beginning with 1944, selection was also made for another character—lateness of spring growth.

By 1947, nearly 63 percent of the crop had some hard seed. And volunteer stands that have been produced on an isolated block since 1948 have stabilized the hard-seed content at 65 to 85 percent.

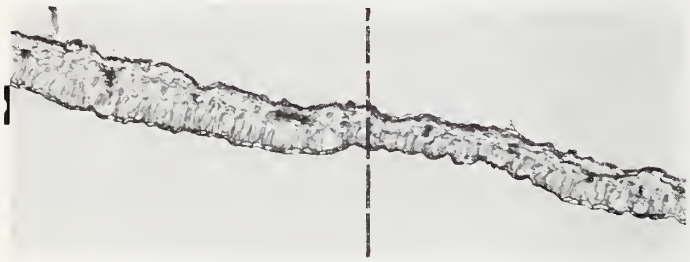
Following these steps, tests for yield and for reseeding were made at the Mississippi Station before the variety was named. Chief, now ready, is the direct descendent of the many generations raised there.☆

Tobacco Bruises Easily

Study reveals physical and chemical damage and points way to improved equipment



BALLS DROPPED from certain heights in cylinder strike disk at bottom with measured energy. Leaves were bruised alike at various stages, effects compared.



BRUISED TISSUES (left) of magnified cross section of leaf have thickened. Such injury to green leaves upsets cell biochemistry, inhibiting later yellowing.

DARK CIRCLES mark bruised tissues that will not yellow properly. Effect (not fully apparent in the photograph) increased from lightest impact (top of left leaf) through middle range to heaviest (right leaf).

LEARNING WHAT HAPPENS when tobacco leaves are bruised is adding to our knowledge of chemical effects of harvesting and curing. This should help us design machines to harvest tobacco with a minimum of damage.

Ripe, mature leaves of tobacco can be inadvertently bruised by normal harvesting and curing operations. These leaves are sensitive living systems—can't take bruising any more than a human. And when they *are* bruised, the result is an unattractive leaf, altered chemical composition, and interference with important biochemical changes that normally occur in curing of the leaf.

Bruising affects yellowed leaves of tobacco, too, although not as drastically. Yellowed leaves aren't chemically altered, but their economically important appearance changes for the worse after curing takes place.

USDA-State research has shown the economic value of gentle handling to obtain good-quality, even-colored, unbruised tobacco. The information will aid in building better protective features into the new tobacco-handling machines that are increasingly replacing hand labor.

Agricultural engineers W. H. Johnson and F. J. Hassler of the North Carolina Agricultural Experiment Station and W. H. Henson, Jr., of ARS, experimentally bruised both green and yellowed tobacco leaves with measured forces. Tobacco bruised while green failed to yellow properly, and bruised areas in the cured leaf showed an undesirable starchy, greenish appearance. This suggests bruising reduced the rate of chlorophyll disintegration.

Yellowed tobacco more sensitive than green

Tobacco that was yellowed before it was experimentally bruised turned an undesirable brown when cured. Yellowed tobacco seemed to be more sensitive to bruising than the green, since uniform bruises were noticeable when smaller forces were applied to the leaves. Bruised tissue of both green and yellowed tobacco was progressively darker as stronger bruising was applied.

Bruising altered the chemical composition of green leaves of tobacco. The conversion of starches into sugars—a process that normally takes place during the leaf's yellowing phase—was greatly slowed down.

Bruising of yellowed tobacco leaves had no noticeable effect on sugars. Most biochemical changes have already reached the desired end point by the time tobacco leaves have yellowed, and these changes come to a stop during the drying phase right after yellowing. ☆

GRASS germinates and starts off better on the dry plains when seeded in the bottom of a furrow than when seeded on the level. Utah studies showed the seed layer of soil in a 4-inch furrow averaged 50 percent more moisture during critical period, April 12–May 20.

DEEP FURROWS—Best for Range Seeding

DEEP-FURROW PLANTING helps take hit and miss out of seeding arid rangelands. USDA tests show that extra depth slows down drying in the seeded layer of soil and retains moisture for germination and growth.

Dryland wheat farmers in some moisture-short areas have successfully adopted deep-furrow planting. But the problem of retaining moisture in range seeding is much more critical. Compared with wheat, grass seed is planted shallow and germinates slowly.

To find out how well extra furrow depth works for range seeding, ARS ran tests cooperatively with the U. S. Forest Service and the Utah Agricultural Experiment Station. They found the method greatly reduces water loss because soil in the furrow bottom is better protected from surface air movement and heat.

Deep furrow increases stand

Deeper furrows retained moisture best, and ARS range conservationist W. J. McGinnies reported that a 4-inch furrow significantly increased stands. His 1-inch furrow did not retain a measurable amount of moisture. Desirable depth, of course, would vary in different soils. Utah tests were made in shallow silt loam, composed about equally of sand, coarse silt, and fine silt and clay.

Deep furrowing also has a bonus benefit. It prevents rapid water runoff and helps check erosion.

Promising as this method is, there are drawbacks, too. Soil and climate may rule out deep furrows. For example, unstable soils may slough into the furrow and cover seed too deeply. Seedlings may be buried under soil washed down by torrential rains, or drowned in the water held in furrows. Another hazard comes from ice that may form and smother seedlings. Furrowing also may not do well if gophers are a problem.

Method needs further study

Further tests need to be made—on degree of furrow slant, compaction, plow devices, and suitable soils—before this range-seeding technique can be adapted for general use. ☆

GREEN MANURE WON'T PAY HERE

GREEN-MANURE CROPS do not pay off for either spring or winter wheat production on Montana drylands where the rainfall averages less than 16 inches a year.

The practice of plowing under cover crops prior to planting wheat has been investigated for 3 to 4 decades by USDA and Montana Agricultural Experiment Station scientists at 3 stations in the drylands. It is accepted practice in areas where moisture supplies are higher.

In humid and irrigated areas, green-manure crops improve soil structure, reduce soil and water losses, increase available soil nitrogen, add organic matter, and reduce plant-food losses that are caused by leaching.

Sweetclover, field peas, and winter rye were grown at Havre, Huntley, and Moccasin. The crops were a partial replacement for the ordinary fallow period and were plowed under in late June or early July of the fallow years. The land was then fallowed until the next crop.

Green-manure plots had lower average yields of spring wheat at all three locations. Those plots outyielded fallow plots in only 3 years out of 28 at Havre, 3 out of 39 at Huntley, and 7 out of 43 at Moccasin.

In 38 years of study at Huntley, green-manure crops never increased winter wheat yield. In fact, green manure partially replacing fallow markedly reduced the yields. In about half of the years from 1914 to 1951, winter wheat at Moccasin showed a small but insignificant gain in yield following green-manure crops.

Sweetclover added only about 20 pounds of available nitrogen per acre to the soil—not enough to pay for land preparation and seeding. Rye added no nitrogen.

Chemical analyses of the soils at the conclusion of the experiments showed no evidence that the green manure crops materially increased nitrogen or carbon—indicators of the amount of organic matter in the soil. ☆

SOME CANES DAMAGE LESS FROM HURRICANES

Study points up importance of variety and stage of growth, plant's ability to recover

SEVERAL COMMERCIAL and experimental varieties stood up as well as this one in a recent hurricane in Louisiana, while other canes were badly broken.

VARIETY AND STAGE of growth make a big difference in hurricane damage to sugarcane, according to a survey of USDA test fields in Louisiana following a recent severe storm.

There was some compensation for broken stalks. Young shoots took advantage of the increased light to develop into millable stalks. In fact, studies showed that the percent reduction in sugar yields per acre was about half the percent of breakage in stalks. The sugar loss was usually less than half with a low percent of stalk breakage, and more than half with a high percent of breakage.

Of the commercial varieties, C. P. 44–101 suffered the most injury. This variety, which comprises 53 percent of the State's sugarcane plantings, had an average stalk loss of over 6 percent in the 3 test fields at Raceland, Oaklawn and at Levert-St. John. C. P. 43–47, C. P. 36–105, C. P. 48–103, and C. P. 44–155 followed in decreasing order of breakage.

ARS agronomists L. P. Hebert and R. J. Matherne of the U. S. Sugarcane Field Station, Houma, La., found that N. Co. 310 was practically unaffected by the hurricane winds at any of the test sites at that stage of growth. Other established varieties—C. P. 36–13, C. P. 29–116, and C. P. 47–193—were only slightly damaged. C. P. 52–68, just released in July, was damaged a little less than the unreleased C. P. 44–101 in the average of all tests, but was more severely damaged in first-year stubble.

A few lines withstood storm

Other unreleased varieties were also damaged. C. P. 48–117 was badly broken at all locations. Three new varieties that haven't performed well enough in agronomic tests to be released—C. P. 52–16, C. P. 52–37, C. P. 52–67—weren't badly hurt.

To accurately appraise severe wind losses, the survey showed it's necessary to consider effects on *all* the stalks rather than individual ones. This is because of changes in development and juice concentration of broken and unbroken stalks.

Thus, in cases where stalks are broken in June rather than August, breakage isn't as severe because the cane has 2 more months to recover.

Another effect of wind damage is waste at harvest because the machines can't pick up the short broken stalks of sugarcane for harvesting.

This survey adds to a growing wealth of information previously provided by other researchers. And it helps to guide growers in estimating expected losses from hurricane winds.

Previous surveys by ARS researchers following hurricanes in 1936 and 1940 showed that some varieties suffered 10 times more damage than others under the same conditions. Later studies on controlled breakage of cane and sugar yields showed that breaking 20 percent of the stalks to simulate hurricane damage in late August cut cane yields 5 percent and sugar yields nearly 10 percent.

Some recovery can be expected

Breaking 100 percent of the stalks in late August reduced cane yields by about 35 percent and sugar yields by about 54 percent. Thus, the percent of reduction in cane yield was slightly less than one-fourth the percent of stalk breakage at the 20 percent level, and slightly more than one-third at 100 percent breakage. ☆

CANE FIELD typifies damage done to many of our commercial sugarcanes during hurricane. A survey showed, however, that some varieties had far less damage and little loss in both cane and sugar.

Till and smother nutgrass

Improved nutgrass eradication has been demonstrated by USDA-State researchers at Mississippi Agricultural Experiment Station, State College. The new method is a combination of smother crop and cross-cultivation.

Three crops—sweet potatoes, cotton, and soybeans—competed against the pernicious sedge in the test.

Nutgrass infestation was reduced 99 percent by sweet potatoes, 81 percent by cotton, and 64 percent by soybeans. The cotton and soybeans yielded about normal (1,700 pounds per acre and 23 bushels per acre, respectively) and the sweet potatoes yielded above normal (513 bushels per acre). All the crops were cross-cultivated 8 times over the 3 years.

Each of the test plots—clay loam soil infested with nutgrass—contained ten 150-foot rows spaced 40 inches apart. A thousand pounds of 5–10–5 fertilizer per acre was broadcast and the ground disked twice. The crops were then planted at the rate of 3 potato slips or 10 to 15 soybean or cotton seeds per hill.

Especially significant, reports ARS agronomist V. C. Harris, was the sharp decrease of live nutgrass tubers when sweet potatoes were grown. Where he found 92 live tubers per sample at the beginning of the experiment, he found only 1 a year later.

An automat for hogs

Automation in the care and feeding of hogs is making it possible to raise hogs in confinement without the relatively high labor costs normally involved in such operations.

Cooperating USDA and State scientists devised the electronically controlled equipment. ARS agricultural engineer H. B. Puckett was assisted in arranging the housing and feeding layout by agricultural engineer E. L. Hanson and animal scientist S. W. Terrill of the Illinois Agricultural Experiment Station, Urbana.

The system automatically (1) maintains constant supplies of feed and water; (2) provides sanitation by periodic washing of an exercise area; and (3) disposes of all wastes.

Motor-driven augers carry the feed to the troughs from mixed-feed hop-

pers. These are supplied directly from a commercial feed mill, which is also automatically operated.

Hogs are housed and fed in a small building at one side of a circular concrete exercise floor. Housing and feeding space is restricted to force hogs that are neither eating nor resting into the exercise area. This helps maintain sanitary conditions in the housing and feeding quarters.

The exercise area is cleaned automatically by a rotating boom that flushes the floor with water under 70 pounds pressure. The floor slants toward the center, where a drain carries the waste to a septic tank.

You can control mesquite

Velvet mesquite, the grass-destroying weed tree, can be controlled in Arizona. Spring spraying of 2, 4, 5–T is the prelude to a slow death, says a USDA range conservationist.

First-year aerial spraying defoliates the trees. Second-year spraying kills 50 percent. Other plants recover slowly, and a third treatment is unnecessary for about 5 years.

Application consists of a half-pound of 2, 4, 5–T per acre mixed in 1 gallon of diesel oil and 4 gallons of water. Full-sized, succulent leaves and completely developed flowers are most susceptible to kill.

Tests were conducted cooperatively with the Arizona Agricultural Experiment Station and the Forest Service at Santa Rita Experimental Range.

ARS range conservationist F. H. Tschirley says as few as 25 mature trees per acre will reduce perennial grass yield 50 percent. Native grasses bounce back rapidly when the mesquite is brought under control.

Reseeding without first controlling mesquite does little to improve ranges. An easily established grass is Lehmann lovegrass, which is both drought tolerant and a prolific seeder.

Over 9,000,000 acres of Arizona range are velvet-mesquite infested. Equally large acreages from Texas to California are infested with honey mesquite and western honey mesquite.

Home economics congress

Home economics research by Federal and State agencies is oriented toward problems of consumers, Director Hazel K. Stiebeling, of USDA's Institute of Home Economics, told the Ninth International Congress of Home Economics meeting at the University of Maryland, College Park.

Homemakers need new kinds of knowledge, skills, and attitudes to get the most from the many new products and services that are becoming available at the present time. Using findings from social, technical, and scientific research, modern home economists can give families information that will help them satisfy their needs by making the best use of their time, money, and other resources.

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The visitors saw examples of home economics research under way at the ARS Agricultural Research Center in Beltsville, Md. These included a demonstration of cooking methods, taste-testing, and chemical anaylsis of food. From such work, home economists formulate cooking directions that give best color, flavor, and nutritive value in foods for the table.

The visitors also saw the school-lunch recipe laboratory and the energy-saving kitchen-workroom designed to make most efficient use of space and homemakers' energy.

Clothing specialists showed garments being designed for handicapped homemakers—garments easy to put on, care for, and wear. Also demonstrated were methods used in testing durability of machine stitching and construction features in articles made from modern fabrics.

The guests were told about recent surveys showing how United States families use their money for everyday living, what they eat, and how their diets rate nutritionwise.

Some 1,000 delegates to the Congress came from 59 countries. The theme was "Education in Home Economics Relative to the Social and Economic Conditions of Countries."

Yearbook deals with land

To use our land with skill and foresight for the greatest good of the people and the land itself is a challenge of USDA's 1958 Yearbook of Agriculture on *Land*. The book, edited by A. D. Stefferud, is available from the Superintendent of Documents, Washington 25. D. C., at $2.25.

Balancing land resources between urban and rural land users is becoming a greater concern of farm economists. Studies of how areas grow and expand are suggesting ways to prevent ugly, haphazard growth and wasted resources in fast-growing communities. Sound planning is also essential for preserving farmlands.

With increasing population and extension of airports, highways, and

factories on the land, researchers must continue finding new ways to use land efficiently and adjust its use to changing cultural patterns.

Research is helping us find ways of reducing the financial uncertainty of farming. Price supports and insurance are stabilizing farm income. Credit has become an essential tool of farmers and is claiming more of our research efforts. Borrowing money to buy land—if wisely done—is good business. The market for farmland is rising, the economists tell us, in the belief that farm income won't be allowed to continue falling.

The 1958 Yearbook is a survey of the land Americans have, need, and use. In this volume, a reader finds the scientific background of land in America combined with practical information on its ownership and use.

Help against cane borer

The sugarcane borer, perennial pest of cornfields in the Southwest, may have two new enemies as a result of USDA-State research. These insecticides, endrin and ryania, are unprofitable for use on average-yielding cornfields at the rates tested, and are not now recommended by the Department. However, they might be profitable with lower dosages and fewer applications on higher yielding corn.

Results of two tests—one on May-planted corn and the other on late-planted corn—were reported by ARS entomologist K. D. Arbuthnot. Tests were conducted at Texas Agricultural Experiment Station, Angleton.

The earlier test consisted of five weekly applications beginning when the corn was in the late-whorl stage of growth. Studies showed that ryania dust was more effective in reducing the number of first-generation borers than endrin used as either granules or a dust. Results were reversed, however, for second-generation borers, as endrin gave better control.

Endrin granules outperformed both of the dusts in reducing borer population in the ears. In the later test, 4 weekly applications were made beginning July 21. Endrin granules proved superior in reducing plant borer infestation, lessening the number of joints and shanks bored, and increasing ear size. Both forms of endrin increased the late-planted corn yields threefold—a greater increase than from ryania-treated plots.

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